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VOICE PRODUCTION FROM THE STANDPOINT OF THE LARYNGOLOGIST.*

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Voice production is a rather hazy subject to the average laryngologist, unless he has devoted especial attention to it.

It would seem, therefore, that a short article on the principles of voice production and a consideration of its treatment relative to those who take up singing as a profession would prove of some value.

The writer's interest in this department began a dozen years ago, when he became an associate of one of the former presidents of this society, a man whose name is inseparably connected with the world of singers.

With the artistic side of the matter the laryngologist has nothing to do, but the physical effects of vocal methods do enter decidedly into his province.

Actual diseased or deformed structures throat specialists agree upon, but not so with functional conditions. By the laryngoscopic mirror alone we can no more pick out a noted tenor than we can an expert tennis player by examining his arm. In fact, by no means, does every singer of reputation have a pair of cords of normal pearly gray color. They may be somewhat dusky in hue, and the whole larynx may appear congested, and the thickened tissue in the posterior commissure be abundant enough to border on the pathologic.

In gross deformities and evident inflammatory diseases of the nose and throat, it is not difficult to decide on the best course of treatment. But in the complaint of a singer it requires very nice judgment to determine that a moderate

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hypertrophy of the lower or middle turbinal body, or that a slight thickening or deviation of the nasal septum, is the cause of the trouble. Nor can we say the disturbance is due to the shrunken remains of an adenoid.

Are you going to extirpate the slight enlargements of the lingual growth which you see?

Can you state positively that her small tonsils are diseased or interfere with the muscular action of the palatal curtain?

To the vocalist these decisions are of the utmost moment, for on the result of your sentence may rest an artist's future, especially if your management of the case demands operative means.

Considerable careful reading and practical experience, in the conditions common to singers and speakers, is necessary for any laryngologist who wishes to undertake this kind of work.

Of course, Tyndall's classic on "Sound," and von Meyer on the "Organs of Speech" are of fundamental value.

Of those authors who address themselves particularly to the departments in which we are interested, we would recommend especially the books of Sir Morell MacKenzie, H. Holbrook Curtis and Wesley Mills, dealing as they do with the mechanism and hygiene of the voice.

Too many of the treatises on these subjects have been written by singers and teachers, often of great renown, which appeal to the vocal student but do not handle the matter enough from the physiologic standpoint for a physician to follow.

The laryngologist should himself take lessons in singing and elocution and listen to instructions given to pupils. Much can be learned also by attending studio performances, the opera, and the study of the phonograph. Discussions, also, with those who are able to criticise the manifold problems and subtleties of voice method are highly profitable.

By such a course he trains his own vocal organs and his musical ear, so that he can not only test out a voice, but illustrate and give an exercise for a pupil to imitate with some degree of confidence. He will be able, also, to understand the sensations and feelings so often described by a teacher or

singer to explain his ideas in connection with the production of tones.

Correct breathing is the basis of good singing; but the demands are quite different from those that are required for purposes of oxidation. We must take in air quickly and without noise, to meet the needs of the most exacting vocal phrasing. But more important than inspiration is proper expiration; how best to attain an even outflow of air under complete control, to permit just enough breath for the sound and no more, as demonstrated by the well known candle experiment—not a flicker of the flame held a few inches from the mouth during the emission of a sound.

Physiologic studies have demonstrated that the type of respiration so successfully used by the old Italian school is the one most preferred today. It earned its position among those natural teachers because it permitted the largest expansion of the chest with the best control of the air in expiration. This has been termed the "inferior costal type of breathing."

The so-called "upper chest," "diaphragmatic" and "abdominal" styles have all had their vogue at various periods. Each of these methods probably has a few supporters even now.

It is to be hoped that in future there will be a greater agreement on the underlying principles of voice production; that gradually there may be a closer cooperation between teacher and physician, all working towards a standardization in our methods of training voices.

To illustrate the "inferior costal type of breathing"—stand erect but not rigid, the shoulders gently thrown back, and somewhat raised, the upper chest immovable and the lower abdomen slightly contracted.

This position permits the best support in expiration, as the diaphragm is thus held tense and alert, allowing a continuous outflow of the air stream, with no unsteadiness or jerkiness. Having the upper chest, as it were, suspended and fixed, regardless of the posture of the singer, any demand made on the voice can be met.

While in everyday life we urge breathing through the nose, in the act of singing or making an address the case is different. Now we must breathe through the open mouth. Otherwise we could not take the air in rapidly enough. This meth-

od tends also to keep the tongue down in the floor of the mouth, with the necessary groove running back through its middle; and the laryngeal box is not pulled upwards, with a consequent tightening of the muscles of the neck.

The volume, or bigness, of a sound depends on the amplitude of its vibrations. A big bawling sound is most unpleasant to the ear, and it soon tires the auditory nerve.

Pitch depends on the number of vibrations in a given period. The healthy ear can distinguish sixteen vibrations per second as its lowest limit, and thirty-eight thousand for its highest. This is a stretch of eleven octaves. However, musical instruments have a range of seven octaves; and much of this is too high to cause a pleasing sensation on our centers of audition.

The average person can sing but two to two and one-half octaves, while in speaking we confine ourselves to a half octave of the middle voice.

The quality of a tone is affected largely by its overtones and harmonics. The blast of air through the glottis, in the case of the voice, sets the vocal bands in motion. This produces the primary sound. This simple neutral sound is somewhat enhanced by the ventricles of the larynx; it gains still more from the pharynx and buccal cavity; the low notes bring the chest walls into vibration as an additional resonator.

The peculiar quality or timbre of the individual voice arises from the accessory sinuses and the bony framework of the face.

Sometimes we are surprised to find in a robust man a small, squeaky voice. This is usually due to poorly developed facial cavities. The Maori of New Zealand possess peculiarly dead voices, though they have magnificent physiques. Anatomic researches show the lack of resonance in their voices is due to an underdevelopment of their accessory sinuses.

As a sound-producing apparatus the larynx is unique. Though comparable to the reed instrument, in the perfection and economy of its mechanism, it far surpasses it. This superiority is due to the fact that by the marvelous action of the laryngeal muscles a single modified reed can take the place of a great many, so placing in the confines of this small box a potentiality not to be found in a cathedral organ.

In the production of sound the larynx is steadied by its extrinsic muscles. During the utterance of deep notes, it is found to occupy a slightly lower position and rises in the ascending scale. The entire distance moved, however, is probably not over the fourth part of an inch. This rise and fall can be easily appreciated by the fingers on the thyroid cartilage during phonation.

Both in speaking and singing in the lower range of the voice, the cricothyroid is the chief muscle. Therefore we find it more used in men than in women, and in basses and baritone than in tenors.

By approximating the anterior part of the cricoid cartilage to the thyroid, it has the capacity of lengthening and making tense the vocal bands. This action can be noted when singing an ascending scale; for one can observe the arytenoid cartilages to move backward and almost out of sight, while there is at the same time a sinking of the posterior parts of the cords.

The thyroarytenoid muscle has a far more complicated action than that of merely drawing the arytenoid cartilage toward the thyroid. The inner fasciculus probably regulates the degree of tension and the elasticity of the vocal cords, possessing, also, the peculiar power of dampening the edges of the bands, just as a finger shortens the string of a violin in a high note; while the other fasciculus, on the other hand, narrows the rima glottidis—that is, it brings the borders closer together along their entire length.

The lateral and posterior cricoarytenoids, when acting alone, respectively approximate and separate the bands, but with the other laryngeal muscles they may operate as tensors.

When singing a high note the arytenoideus closes the posterior part of the glottic chink.

As the highest notes are reached there is also sphincter action about the entire superior orifice of the larynx, the whole organ appearing appreciably smaller.

If you ask a trained singer to run a scale from his low to his high notes, you will notice that when he reaches a certain point in his middle range a change begins from now on in the quality of his voice. It loses a certain loudness and open-

ness and, as it were, sounds more covered up in the inside of the head.

This bridging over from the lower or chest notes to the head or covered notes may occur with a smoothness that makes the process unnoticeable, while on the other hand, the transition may be so pronounced that it causes a "break" in the voice. This alteration from a lower to a higher voice is designated as a change in the registers of the voice. Just as there is a change of gears in an automobile to accommodate itself to a change of speed, so there is a change of mechanism in the voice to adapt itself to the change in pitch.

According to Behnke, "a register is a series of tones which are produced by the same mechanism." A new register marks a change in the quality of a tone corresponding to the change in mechanism, and at the point where that variation occurs we term it the "break" in the voice.

In listening to a Sembrich there is such a perfection of method, gained through years of study, that an entire composition may be sung without the audience being aware of any such thing as registers.

Some teach that there are two registers, others three or even five. In fact, for every variety of note a different adjustment is probably required, though too slight to be perceptible.

But for practical purposes we can regard two registers as sufficient. We can add as a third the falsetto, which is not a genuine tone. This is a very high note of clear bird-like quality produced by male singers. It is created without the diaphragmatic support of the air column, and there is no dampening of the vocal bands in its formation; they are apart throughout their whole length, the vibration taking place on the very edges of the cords, if we are to believe Lehfeldt.

In the production of the falsetto there is a sudden readjustment from the previous high but natural note, followed by a sense of comfort in its performance. If well executed, or better, well disguised, it may prove of great utility on certain occasions.

To recapitulate: During phonation in the lower and middle range the vocal bands do not touch, as the cricothyroid is a tensor muscle, and the intrinsic muscles do not come into play during this part of the mechanism.

But as the scale ascends the cartilaginous glottis is closed by the arytenoideus, the cords come together more and more, both anteriorly and posteriorly, till on the very highest notes only a small oval opening is evident in the front third of the glottic fissure. It is at this period that the thyroarytenoid is effecting its complex adjustment, acting in conjunction with the lateral and posterior cricoarytenoids.

If the falsetto voice is used the cords again return to their original position; that is, apart for their entire length.

As previously stated, to give one an understanding of the application of registers, without some practice under a teacher, is most difficult.

There are certain terms used in the singing world of which we as laryngologists must gain a working knowledge. The covered voice was described with the discussion of registers. We should appreciate the difference between singing "too white" and "dans le masque." In the former method the voice is brought too far forward in the mouth; the tones are clear cut but colorless, and they do not charm, for they lack overtones. In the tones sung too "dans le masque" the voice is confined in the facial cavities, and where we have this to excess the quality of the tones becomes too covered and "hooty." This shuts up the voice, prevents singing high notes and interferes with clear diction. This is not a difficult fault to rectify, but sufficient to keep a good voice in the ranks of mediocrity, if continued.

The term "stroke of the glottis," or "coup de glotte," originally referred to the correct attack of a tone, the proper adjustment of the tension of the vocal cords to the column of expired air. Its meaning now is quite the opposite: a sudden attack with the throat muscles rigid and the vocal cords over-tense, with margins that touch along their middle in the production of the sound. This is a serious fault, and one that is certain to bring disaster to the voice.

The tremulo in good singing today is never justified, and ordinarily we find it is a defect due to an uncertain attack and a poor respiratory support.

Far more than the actor, a singer must hold his emotions under control. The gallery loves a throbbing open tone on a top note, but the man who commits this injury to himself will soon require the throat specialist.

At what age should vocal lessons begin? We may answer: At any time; the earlier the better, but with strict limitations in the compass of the voice, as at a tender age the organ cannot withstand the strain of unusual effort.

Still we must bear in mind that in early life the memory and initiative faculties are at their best, and these natural characteristics should be taken advantage of.

Choral singing, in our institutions, on the other hand, is harmful. For, though it may teach the elements of music, no attention is given to tone placement; the pupil sings beyond his range, and each one tries to outdo his neighbor. This procedure often results in voice strain and blasts forever an innately excellent organ.

Were an attention, at all proportional to its importance, given to expressive reading and elocution in our schools, we would not find so many adults with wooden voices and slovenly methods of speech. What greater possession than a well modulated voice and clear enunciation. And yet how few appreciate these facts?

We must employ great judgment in advising the use of the voice during the early period of adolescence, when the larynx is undergoing its most rapid growth. If the alteration is gradual, moderate exercises may be permitted, but within prescribed limits. Voices, however, which are unsteady or husky at this age, which often "crack," show evidences of laryngeal congestion, and in such cases singing or any harsh use of the vocal apparatus must be interdicted for a year or more, if necessary.

Really not until the age of twenty-three or four does the larynx reach its full development, when it is competent to endure serious vocal training.

Every laryngologist should know several reliable vocal teachers, to whom he can intrust his musical patients.

In the fundamentals of voice production, we can state that a man is the better teacher for a man, and a woman for a woman.

Be most particular in the selection of your first teacher, for a pupil should be so trained from the beginning that he will not be compelled to unlearn incorrect methods later on. Studios are filled with those who have made such a mistake.

Ordinarily one can judge best of a teacher by the recognized results he has had with his pupils.

Do they sing well? Do their voices improve? These are the first questions to ask.

Remember, we laryngologists are not singing teachers. With the divine art of song we have nothing to do in the consulting room. But whatever pertains to the actual voice, the effects from good or bad instruction, as noted on the vocal apparatus, do decidedly fall within our jurisdiction.

To excel as a teacher he must know his subject, have unbounded enthusiasm, and possess a sympathetic insight into the needs of his pupils.

It is unnecessary for him to be an eminent singer. In fact, the drudgery of teaching tone work would very often be repellent to anyone fitted for the concert, stage, or opera.

Still he must have a voice so trained that he can demonstrate a correct tone, and it is a great advantage to imitate a student's own mistakes and then to sing the part faultlessly to him. It is often far superior to a long explanation and better keeps up the interest of the pupil.

The best teacher depends on his ear, and not on the laryngoscope. He should not regard himself as an instructor of anatomy and physiology. To indicate any more than the gross divisions of anatomic science to a pupil will not assist him; rather, it will make him overconscious than otherwise.

To bully and tyrannize over his pupils is absolutely wrong; for a singer's nature is altogether too sensitive to endure such rough measures. The nervous organization of one of our great singers is of different mould from that of the humdrum individual. We average mortals try to explain that difference by the words "artistic temperament." At any rate, we know an artist possesses a spark that reaches out into spaces quite unknown to most of us.

If a pupil fails to make progress, if he is hoarse after his exercises, has difficulty in understanding his teacher, and is becoming discouraged, you can be certain that he must find his instruction with someone else.

Let us now consider a few types of cases such as a throat man might have visit his office.

Case 1 is that of a young man, a tenor in a church choir.

He states that his first teacher considered him a baritone who had some tenor notes. With this man he made excellent progress, and his exercises and songs were kept well within his range. Two years ago he met a teacher who classed him as a robust tenor. This prospect seemed too alluring to neglect, so he put himself under his direction. For a time he improved, at least he said his range was higher by several notes; and though he had not yet reached high C, he hoped soon* to do so.

His first serious trouble began when he received a church position. The music always seemed too high for him, though by an effort he got through his parts. Of late, however, he noticed a tremulo in his voice, and a certain unsteadiness, and often after a performance his throat ached, and there was a huskiness in speaking. He also added that he is now losing his lower notes, and that the general quality of his whole voice is not so good.

You ask the young man try a scale and you find his higher notes lose their freedom; they sound pinched. Having him run down the measure, you recognize at once that here lies his natural voice, though it sounds wooden.

On examining his nose, you find a high deviation of the septum, while the cords are somewhat wavy in outline—and that in singing a high note on “Day” or “Hay” you see the glottis is open its entire length.

Such an examination clearly proves that this patient is not a tenor; that he has been forcing his voice so that the inner fibers of his thyroarytenoid no longer act. The “long reed” type of glottis still further confirms the idea that the patient has a voice of medium range only.

The high septal deformity does perhaps interfere with his highest notes, but as those do not belong to his natural range, no operation on the septum is necessary, especially as the septum is producing no other symptoms.

The conclusions to be drawn are evident. The man has attempted to outdo nature. You cannot create a voice; you can only improve the one you already possess.

Let his voice drop back to the place where it properly belongs, and again he will sing as he did formerly, as thus far no permanent injury has been done.

Case 2 is that of a young comic opera star, whose company opened two weeks ago. After singing for a week she thought she had contracted a slight cold. Her middle voice and piano notes are poor, while her high notes are as good as ever. She is hoarse after a performance.

Her nose and pharynx manifest slight evidences of congestion. The larynx is in the same condition; the cords have a dusky hue and bulge towards the center. On light phonation one observes a single spot just anterior to the middle where the mucus adheres. Under this on the margin of each cord is a minute tumefaction with an area of redness about it. Closer study of these growths shows them to be the size of a pin-head; they appear harder than the surrounding tissue, and seem embedded in it. Their location is exactly at the point where the bulging cords touch.

The diagnosis is a traumatic laryngitis with singer's nodes, due to faulty voice production.

The supposed cold is merely the congested state of the upper respiratory tract resulting from the voice strain.

In such cases the upper notes remain clear, because when the cords are tense the edges do not rub. But in the middle voice and piano notes, the cords are relaxed and at their most convex point, from the attrition of the edges, the nodules quickly develop.

In all cases of vocal disability due to voice strain, examine for the bulging margins of the bands.

The little vibrating pearl of mucus reveals the point of origin of the vocal nodule.

Light opera music is not written with the thought of saving voices, but rather for striking vocal effects.

Is it any wonder that the prima donna, often selected for her beauty and youth, breaks down early in her career? It takes six years of painstaking work to prepare a singer for the operatic stage—and yet for a light opera the principal star is frequently selected before she has grasped the rudiments of voice culture.

What are the indications for treatment in a case of this kind? Local measures and prolonged rest, you may say.

Applications, inhalations and sprays have little effect, except to soothe or act as slight counter irritants. Prolonged

rest is out of the question with this class of people. They must sing or they lose the place they have so labored to attain.

The exercises instituted and developed by Dr. H. Holbrook Curtis bring the most satisfactory results in the shortest time. Numerous articles of his have thoroughly explained this method of treatment in the voice strain of singers.

The general idea is that instead of giving the vocal organs complete rest, the patients are to be given exercises to counteract the damage done—in the same fashion as one who has tired his arms by climbing a rope can quickly restore their elasticity and vigor by using the punch bag. For wrong methods of singing, which brought the cords together, are substituted those that exercise and in a way massage them, but do not permit them to touch.

The patient is requested to whisper instead of being allowed to talk. He is to practice humming exercises every hour during the day for a few minutes.

To briefly describe the technic of performing the hum: We have the patient sip in some air through the mouth, then close the lips, with the teeth a pencil's breadth apart, think of the word "maw" or "naugh," in the most comfortable pitch of his middle voice, and then first sing the word in the closed mouth, bringing it forward till you can feel the lips vibrate with the sound, when by flecking the under lip the explosive note "maw" or "naugh" escapes.

By ascertaining in this manner that the sound is correctly placed, let it, as it were, burst through the lips. It should be clear and even. After some practice he can go up and down the scale with it, and then in a day or two he may try his songs, using, however, the word "maw" at first in place of the words of the song.

In a remarkably brief period voices have been restored by this method, and the patients been enabled to return to their occupations.

Case 3 has many of the symptoms of the former patient: the voice tires easily; it is losing its attractive quality, and there seems a certain breathiness of tone.

By laryngoscopic examination you find cords that are neither wavy in outline nor bulging. Instead, they are bowed, with an elliptical opening.

Such a condition arises from voice strain also; too much air is used in the production of a tone, till finally the thyroarytenoid muscle, yielding to the strain, causes the oval opening of the glottis with a weak, breathy result. It can be occasioned, too, by practicing exercises excessively that contain too many open vowels.

The principles of treatment here are to properly apportion the amount of air to the needs of the voice, and to make use of the exercises suggested for the benefit of the previous case.

It is to be hoped by the writer that even though every laryngologist is not endowed with a keen musical taste, he need not consider that the subject belongs to a domain in which he can have no part; that he will discover, by applying his anatomic and physiologic knowledge to the principles of voice production, and by training his own ear and voice, he may find this branch of his specialty of increasing interest and profit to himself as well as to the vocalist.